PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 13 October 2000 (13.10.00)	
International application No. PCT/US00/01702	**Applicant's or agent's file reference** 3029-72
International filing date (day/month/year) 24 January 2000 (24.01.00)	**Priority date** (day/month/year) 25 January 1999 (25.01.99)
Applicant SURJAN, James et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

15 August 2000 (15.08.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Marie-José Devillard

Telephone No.: (41-22) 338.83.38

ATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 3029-72	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US00/01702	International filing date *(day/month/year)* 24 January 2000 (24.01.2000)	Priority date *(day/month/year)* 25 January 1999 (25.01.1999)
International Patent Classification (IPC) or national classification and IPC IPC(7): H05B 3/34 and US Cl.: 219/549		
Applicant SURJAN, JAMES		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☑ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
15 August 2000 (15.08.2000)	30 April 2001 (30.04.2001)
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Tu Hoang T. Hurley for Telephone No. (703) 308-3303

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/U[redacted]1702

I. Basis of the report

1. With regard to the elements of the international application:*

☒ the international application as originally filed.

☒ the description:
pages 1-14 as originally filed
pages none , filed with the demand
pages none , filed with the letter of _____.

☒ the claims:
pages none , as originally filed
pages none , as amended (together with any statement) under Article 19
pages none , filed with the demand
pages 15-18 , filed with the letter of 19 December 2000 (19.12.2000)

☒ the drawings:
pages 1-3 , as originally filed
pages none , filed with the demand
pages none , filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/~~fig~~ _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US [redacted]702

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims none	YES
	Claims 1-23	NO
Inventive Step (IS)	Claims none	YES
	Claims 1-23	NO
Industrial Applicability (IA)	Claims 1-24	YES
	Claims none	NO

2. CITATIONS AND EXPLANATIONS (Rule 70.7)

Claims 1-2, 5-12, 14, 16, and 20-22 lack novelty under PCT Article 33(2) as being anticipated by Aune et al. Aune et al shows a self regulating flexible heater comprising a woven flexible fabric substrate having a layer of PCT material 3, a layer of conductive material 11,12 in the form of conductive wires fixed within a construction 6 by conductive glues, a plurality of buss bars 1,2 in electrical contact with the conductive material (see column 7, lines 37-55, and Figures 1-2.

Claims 1-21 and 23 lack novelty under PCT Article 33(2) as being anticipated by Watts. Watts shows a self regulating flexible heater comprising a woven flexible fabric 14, a layer of PCT material 40 applied a layer of conductive material 32,34,36,38 in an interdigitated pattern, a plurality of buss bars 16,18, and an overlayer of laminated woven synyhetic fabric 12 (see Column 2, lines 42 to column 3, line 34 and Figures 1-2.

Claims 1-4, 6, 10-14, 16, and 20-23 lack novelty under PCT Article 33(2) as being anticipated by Kochman et al. Kochman et al shows all features of the claimed invention including a flexible heater comprises the PCT layer. See Figures 10A-10C, column 6, lines 1-26 and olumn 11, lines 26-39.

Claims 1-14, 16, and 20-21 lack novelty under PCT Article 33(2) as being anticipated by Sullivan et al. Sullvian et al shows a self regulating flexible heater 2 comprising a woven flexible fabric substrate having a layer of PCT material 50 disposed and supplied in a generally serpentine or interdigitated pattern with a layer of conductive material 46,48 in the form of conductive wires 60, a plurality of buss bars 26 in electrical contact with the conductive material, and an overlayer or cover 10.

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the questions whether the claims are fully supported by the description, are made:

Claim 24 is objected to under PCT Rule 66.2(a)(v) as lacking clarity under PCT Article 6 because the claim is indefinite for the following reason: In claim 24, "the seat heater composition" lacks antecedent basis in the claim.

WE CLAIM:

1. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

   a flexible fabric substrate;

   a first layer of a positive temperature coefficient (PTC) material; and

   a second layer of conductive material.

2. The heater of claim 1 wherein the substrate is woven or non-woven fabric.

3. The heater of claim 1 wherein the layer of conductive material is applied to the layer of positive temperature coefficient material in an interdigitated pattern.

4. The heater of claim 1 wherein the layer of positive temperature coefficient material is applied to the layer of conductive material in an interdigitated pattern.

5. The heater of claim 1 wherein the density of the fabric is 1 to 6 ounces per square yard.

6. The heater of claim 1 wherein the PTC material is comprised of a polyolefin resin.

7. The heater of claim 1 wherein the coating of PTC material has a weight 7 to 20 lbs. per ream.

8. The heater of claim 1 wherein the positive temperature coefficient material has a surface resistivity of 2 to 10 kilo-ohms as measured by multimeter probes set 1 cm apart.

9. The heater of claim 1 wherein the positive temperature coefficient material has a surface resistivity of 3 to 8 kilo-ohms as measured by multimeter probes set 1 cm apart.

10. The heater of claim 1 wherein the conductive material is formulated from a mixture of a polymeric resin selected from the group consisting of vinyls, polyesters, acrylics and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

11. The heater of claim 1 wherein the conductive material is formulated from a mixture of solvating materials selected from the group consisting of organic solvents and water based solvents and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

12. The heater of claim 1 wherein the conductive material is constructed of conductive wires fixed within the construction by conductive glues.

13. The heater of claim 1 wherein the first and second layers are applied to the substrate by screen printing, spraying, draw down, web printing or any printing method capable of providing a uniform coating.

14. The heater of claim 1 further comprised of a plurality of buss bars in electrical contact with the conductive material and an electrical power source.

15. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width decreases over at least a portion of its length.

16. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width remains constant over at least a portion of its length.

17. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and at least one void at a predetermined location along its length.

18. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width dimension increases step-wise over at least a portion of its length.

19. The heater of claim 14 wherein the spacing of the busses varies across the heater.

20. The heater of claim 1 further comprised of an overlayer of a laminated or sewn secondary breathable woven or non-woven fabric comprised of natural or synthetic fibers which covers the heater.

21. The heater of claim 20 wherein the overlayer is an encapsulating coating, which may be a flame retardant coating, which is applied over the heater.

22. The heater of claim 1 wherein the heater is incorporated within a construction of a seat for an automobile.

23. The heater of claim 1 wherein the heater has a multiple buss design providing for high and low current settings, comprised of at least a common setting buss, a low setting buss, and a high setting buss, in which current flows from either the common setting buss to high setting buss or from the common setting buss to low setting buss.

24. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

a flexible fabric substrate;

a layer of a positive temperature coefficient material; and

a layer of conductive material, wherein the seat heater composition has a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s or greater.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 3029-72	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US00/01702	International filing date *(day/month/year)* 24 January 2000 (24.01.2000)	Priority date *(day/month/year)* 25 January 1999 (25.01.1999)
International Patent Classification (IPC) or national classification and IPC IPC(7): H05B 3/34 and US Cl.: 219/549		
Applicant SURJAN, JAMES		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

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3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

CORRECTED VERSION

Date of submission of the demand	Date of completion of this report
15 August 2000 (15.08.2000)	13 August 2001
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Tu Hoang Diane Smith for Telephone No. (703) 308-3303

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US00/01702

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed.

☒ the description:
pages 1-14 as originally filed
pages none, filed with the demand
pages none, filed with the letter of _____.

☒ the claims:
pages none, as originally filed
pages none, as amended (together with any statement) under Article 19
pages 15-17, filed with the letter of 19 December 2000.
pages 18, filed with the letter of 13 June 2001 (13.06.2001).

☒ the drawings:
pages 1-3, as originally filed
pages none, filed with the demand
pages none, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

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☐ the description, pages ____

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☐ the drawings, sheets/~~fig~~ ____

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*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International [redacted]ation No.
PCT/US00/01702

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 24	YES
	Claims 1-23	NO
Inventive Step (IS)	Claims 24	YES
	Claims 1-23	NO
Industrial Applicability (IA)	Claims 1-24	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS (Rule 70.7)

Claims 1-2, 5-12, 14, 16, and 20-22 lack novelty under PCT Article 33(2) as being anticipated by Aune et al. Aune et al shows a self regulating flexible heater comprising a woven flexible fabric substrate having a layer of PCT material 3, a layer of conductive material 11,12 in the form of conductive wires fixed within a construction 6 by conductive glues, a plurality of buss bars 1,2 in electrical contact with the conductive material (see column 7, lines 37-55, and Figures 1-2.

Claims 1-21 and 23 lack novelty under PCT Article 33(2) as being anticipated by Watts. Watts shows a self regulating flexible heater comprising a woven flexible fabric 14, a layer of PCT material 40 applied a layer of conductive material 32,34,36,38 in an interdigitated pattern, a plurality of buss bars 16,18, and an overlayer of laminated woven synyhetic fabric 12 (see Column 2, lines 42 to column 3, line 34 and Figures 1-2.

Claims 1-4, 6, 10-14, 16, and 20-23 lack novelty under PCT Article 33(2) as being anticipated by Kochman et al. Kochman et al shows all features of the claimed invention including a flexible heater comprises the PCT layer. See Figures 10A-10C, column 6, lines 1-26 and olumn 11, lines 26-39.

Claims 1-14, 16, and 20-21 lack novelty under PCT Article 33(2) as being anticipated by Sullivan et al. Sullvian et al shows a self regulating flexible heater 2 comprising a woven flexible fabric substrate having a layer of PCT material 50 disposed and supplied in a generally serpentine or interdigitated pattern with a layer of conductive material 46,48 in the form of conductive wires 60, a plurality of buss bars 26 in electrical contact with the conductive material, and an overlayer or cover 10.

Claim 24 meets the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest a self regulating flexible heater construction having a layer of conductive material which has a bulk density of about $0.6g/cm^3$ or greater and a thermal diffusivity of about $0.003cm^2/s$ or greater.

WE CLAIM:

1. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

   a flexible fabric substrate;

   a first layer of a positive temperature coefficient (PTC) material; and

   a second layer of conductive material.

2. The heater of claim 1 wherein the substrate is woven or non-woven fabric.

3. The heater of claim 1 wherein the layer of conductive material is applied to the layer of positive temperature coefficient material in an interdigitated pattern.

4. The heater of claim 1 wherein the layer of positive temperature coefficient material is applied to the layer of conductive material in an interdigitated pattern.

5. The heater of claim 1 wherein the density of the fabric is 1 to 6 ounces per square yard.

6. The heater of claim 1 wherein the PTC material is comprised of a polyolefin resin.

7. The heater of claim 1 wherein the coating of PTC material has a weight 7 to 20 lbs. per ream.

8. The heater of claim 1 wherein the positive temperature coefficient material has a surface resistivity of 2 to 10 kilo-ohms as measured by multimeter probes set 1 cm apart.

9. The heater of claim 1 wherein the positive temperature coefficient material has a surface resistivity of 3 to 8 kilo-ohms as measured by multimeter probes set 1 cm apart.

10. The heater of claim 1 wherein the conductive material is formulated from a mixture of a polymeric resin selected from the group consisting of vinyls, polyesters, acrylics and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

11. The heater of claim 1 wherein the conductive material is formulated from a mixture of solvating materials selected from the group consisting of organic solvents and water based solvents and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

12. The heater of claim 1 wherein the conductive material is constructed of conductive wires fixed within the construction by conductive glues.

13. The heater of claim 1 wherein the first and second layers are applied to the substrate by screen printing, spraying, draw down, web printing or any printing method capable of providing a uniform coating.

14. The heater of claim 1 further comprised of a plurality of buss bars in electrical contact with the conductive material and an electrical power source.

15. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width decreases over at least a portion of its length.

16. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width remains constant over at least a portion of its length.

17. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and at least one void at a predetermined location along its length.

18. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width dimension increases step-wise over at least a portion of its length.

19. The heater of claim 14 wherein the spacing of the busses varies across the heater.

20. The heater of claim 1 further comprised of an overlayer of a laminated or sewn secondary breathable woven or non-woven fabric comprised of natural or synthetic fibers which covers the heater.

21. The heater of claim 20 wherein the overlayer is an encapsulating coating, which may be a flame retardant coating, which is applied over the heater.

22. The heater of claim 1 wherein the heater is incorporated within a construction of a seat for an automobile.

23. The heater of claim 1 wherein the heater has a multiple buss design providing for high and low current settings, comprised of at least a common setting buss, a low setting buss, and a high setting buss, in which current flows from either the common setting buss to high setting buss or from the common setting buss to low setting buss.

24. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

a flexible fabric substrate;

a layer of a positive temperature coefficient material; and

a layer of conductive material, wherein said layer of conductive material comprises a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s or greater.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
GERALD LEVY
PITNEY, HARDIN, KIPP AND SZUCH LLP
711 THIRD AVENUE
NEW YORK, NY 10017

RECEIVED
MAY 21 2001
PITNEY HARDIN KIPP & SZUCH LLP.

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing *(day/month/year)*	17 MAY 2001
Applicant's or agent's file reference 3029-72	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US00/01702	24 January 2000 (24.01.2000)	25 January 1999 (25.01.1999)

Applicant

SURJAN, JAMES

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

DOCKET NO. _____
REF'S _____
PITNEY, HARDIN, KIPP & SZUCH LLP
711 THIRD AVE., N.Y.C.

Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Tu Hoang Telephone No. (703) 308-3303

Form PCT/IPEA/416 (July 1992)

Attorney Docket No: 3029-72 US
Express Mail Label: ET025234409US

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
GERALD LEVY
PITNEY, HARDIN, KIPP AND SZUCH LLP
711 THIRD AVENUE
NEW YORK, NY 10017

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing *(day/month/year)*	17 MAY 2001
Applicant's or agent's file reference 3029-72	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US00/01702	24 January 2000 (24.01.2000)	25 January 1999 (25.01.1999)

Applicant

SURJAN, JAMES

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Tu Hoang
Facsimile No. (703)305-3230	Telephone No. (703) 308-3303

Form PCT/IPEA/416 (July 1992)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 July 2000 (27.07.2000)

PCT

(10) International Publication Number
WO 00/43225 A3

(51) International Patent Classification[7]: H05B 3/34

(21) International Application Number: PCT/US00/01702

(22) International Filing Date: 24 January 2000 (24.01.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/117,144 25 January 1999 (25.01.1999) US

(71) Applicant *(for US only)*: **CHIOVATERO, Antoinette** (executrix for the deceased inventor) [US/US]; 3819 North Francisco, Chicago, IL 60618 (US).

(71) Applicant *(for all designated States except US)*: **ILLINOIS TOOL WORKS INC.** [US/US]; 3600 West Lake Avenue, Glenview, IL 60025 (US).

(72) Inventor: **KISH, Fred, A.** (deceased).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **SURJAN, James** [US/US]; 5N479 Farrier Point, St. Charles, IL 60175 (US). **VARMA, Tilak, R.** [IN/US]; 18451 West Springwood Drive, Grayslake, IL 60030 (US). **BULGAJEWSKI, Edward** [US/US]; 31164 Oakview Drive, Genoa, IL 60135 (US).

(74) Agents: **LEVY, Gerald** et al.; Pitney, Hardin, Kipp and Szuch LLP, 711 Third Avenue, New York, NY 10017 (US).

(81) Designated States *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.

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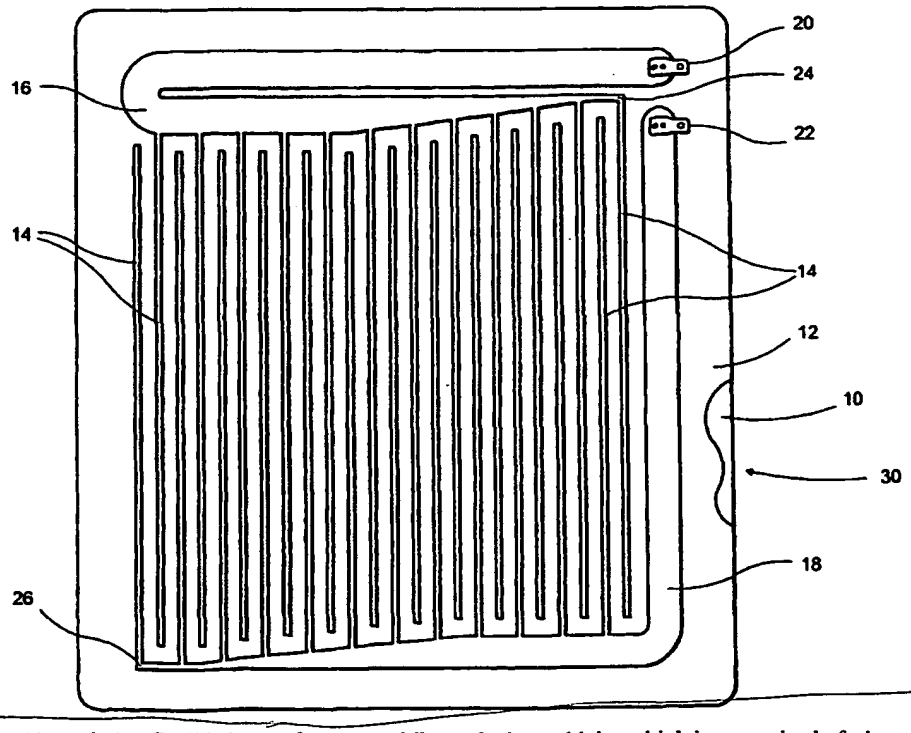
(54) Title: SELF REGULATING SEAT HEATER



(57) Abstract: A self-regulating flexible heater for automobiles and other vehicles which is comprised of a breathable substrate (10) to which is applied a coating (14) of a conductive material and a coating (12) of positive temperature coefficient material.

WO 00/43225 A3

SELF REGULATING SEAT HEATER

Field of the Invention

The invention relates to a self-regulating flexible heater construction suited for use in automobile components but which has use in other applications, including but not limited to furniture pieces, consumer items, construction materials, and other articles. The flexible heater construction is comprised of a breathable fabric substrate to which is applied a coating of a conductive material and a coating of positive temperature coefficient ("PTC") material. The conductive material is in electrical contact with a power source. The PTC material regulates the temperature of the heater.

Within the automotive field, the present invention can be employed as a seat heater and, to provide a non-exhaustive list of other applications, as a heater for dashboards, steering wheels, stick shifts (for manual and automatic transmissions), mirrors, arm rests, and others.

Background of the Invention

Heating devices with temperature self-regulating properties are used in the automotive industry. However, such heaters are employed where flexibility of the heater is not at issue. For example, such heaters are used on mirrors located outside of the vehicle. These heaters are printed upon a rigid biaxially oriented polyester film. See, e.g. U.S. Patent nos. 4,931,627 and 4,857,711, both assigned to the assignee of the present application.

Heaters for automotive vehicle seats that are currently available offer less than adequate performance due to several undesirable attributes. Current heaters are known to build up static electricity, which damages the heater controller circuit when it is discharged. Another shortcoming is that current seat heater design, in which the heater elements are copper wire and

design creates several problems in that heating is localized to the area of the wires, creating an undesirable heating pattern where the areas in the vicinity of the wire are too hot and areas removed from the wire are too cool. Moreover, since the heating wire per se does not possess any means for regulating the temperature (that is, copper wire and the like is incapable of sensing that it has become too hot), a sophisticated temperature controller is required for regulating the temperature of the seat heater. This creates a challenging design problem for the engineer, which could be avoided if the heater construction per se was self-regulating and could increase or decrease the amount of heat produced as necessary.

Furthermore, when heating a seat in an automotive vehicle, it is evident that the seat heater construction must be flexible, durable, and able to withstand the demands of the operating environment, which include the potentially degradative effects of prolonged exposure to heat and the flow of electricity.

It would be desirable if a heater for an automotive seat were deigned so that a uniform amount of heat could be distributed over the area to be heated. Likewise it would be desirable if a seat heater could be designed in which, if desired, the amount of heat delivered to particular area could be varied as a design parameter, so that if it is deemed that certain areas should be warmer than others for a given design (or cooler, as the case may be), the heater could be constructed to accommodate this variation.

Furthermore, since the comfort of a vehicle seat is attributable to its flexibility, it would be desirable if the seat heater construction was flexible so that its presence in the seat complimented the other flexible components of the seat construction. It would be additionally desirable if the seat heater construction incorporated a flexible fabric layer. It would be highly

advantageous if the heater components could be applied to the fabric using well known printing and coating techniques, which could be used to construct a heater quickly and easily, and relatively cheaply. Also, application techniques such as printing or coating could be used to make uniform or varying applications of component materials, which could provide for the uniform distribution of heat, or if desired, variations in the amount of heat.

Positive temperature coefficient (PTC) materials exhibit variable electrical resistance with temperature. As the temperature of the material increases, the electrical resistance also increases. The resistivity of the material increases so current flow is reduced, limiting heat flow. In essence, positive temperature coefficient compositions are used to form temperature self-regulating coatings. PTC materials are known in the art. Exemplary disclosures concerning these materials can be found in U.S. Patent nos. 5,206,482 and 5,151,747, among others.

Summary of the Invention

The present invention is directed to a self regulating flexible heater, such as a heater for use in automobiles and other vehicles, in which a PTC material and conductive material are applied to a woven or non-woven fabric that is constructed of natural or synthetic fibers.

An electrical buss system of a conductive material is applied over a fabric before or after being coated with a PTC material. The conductive material is applied in an interdigitating pattern emanating from multiple buss bars. The buss bars are configured such that the heater offers uniform heating across the surface of the heater. The amount of heat generated may also be varied as a design parameter so that certain regions generate more or less heat as desired. The buss bars can be connected to the power source by a variety of interconnection devices such as fasteners, terminals conductive epoxies, to name a few of a broad range of interconnecting means

that would be within the realm of the skilled artisan. Wire connectors are attached to the terminals and the wire from the power source. Preferably, a secondary layer is applied over the heater construction, such as an adhesive layer or a breathable fabric. The breathable fabric may be one that is breathable by virtue of the material that is used, or one that is machined to be breathable, such as by needle punching.

The heater element is applied just under the external layer of the vehicle seat, preferably as close to the end user as possible. The heater element is placed on the base of the seat, or on the back of the seat, or both. Preferably, the coating of PTC material has a weight 7 to 20 lbs per ream (that is, 3300 $ft.^2$) and a surface resistivity of 2 to 10 kilo-ohms as measured by mulitimeter probes set 1 cm apart. More preferably the coating of PTC material has a surface resistivity of 3 to 8 kilo-ohms as measured by mulitimeter probes set 1 cm apart.

Suitable materials for the fabric substrate include woven and non-woven fabric constructions of material including but not limited to polyesters, polyamides, polyaramids, polyimides, polyetherketones, glass fibers, phenolics, and carbon fibers. With respect to the fabric selection process, it has been found that heater constructions having a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s or greater insures a desirable degree of conductivity and heat flow through the fabric. This can be achieved using multifilaments with a relatively high number of twists per inch. However, a high degree of twists, or even using high denier fibers, reduces fabric flexibility. Accordingly, the skilled artisan should strike a balance between these properties.

The heating element may comprise a coating formed from a composition of a conductive material of electrically conductive particles dispersed in a polymer matrix, and a coating of a

PTC material. In the self-regulating heater of the present invention, the heating element is in thermal communication with the component to be heated, such as the automobile seat. Preferably, the PTC material is coated onto a woven or non-woven fabric. The conductive material is applied, either before or after the PTC material is applied. The conductive material is coated onto the fabric in an interdigitating pattern of electrodes which forms an electrical buss system, which can be constructed in a variety of patterns, such as in a tapered shape (see e.g., Figure 1) , a stepped shaped, in which size varies in a step arrangement, or in a straight, or constant size over the entire construction. (see e.g., Figure 3) A trim pattern is also possible in which voids are present in the busses at preselected locations. The edges of the buss system are connected to multiple buss bars in electrical contact with a power source.

In one aspect of the present invention, the self-regulating flexible heater is a coated fabric whose construction has a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s.

In another aspect of the invention, an encapsulating coating, which may be a flame retardant coating, is applied over the heater elements by lamination or the or other known techniques.

Brief Description of the Drawings

Figure 1 is a top plan view showing the heater of the present invention.

Figure 2 is a top plan view of the circuit of a dual wattage self-regulating flexible heater construction.

Figure 3 is a top plan view of a self-regulating flexible heater construction having a

tapered and straight buss bar arrangement.

Detailed Description of the Preferred Embodiment

In the preferred embodiment, a polyester woven or non-woven fabric 10 of a density of about 1 to 6 ounces per square yard (more preferably, about 3.7 ounces per square yard) is coated with a PTC material 12 such as commercially available PTC coating materials, such as an ethylene-vinyl acetate co-polymer resin available as Dupont 265. Such materials are described in U.S. Patent no. 4,857,711, incorporated herein by reference. The coating is applied at a weight of 13 lb per ream (that is, 3300 $ft.^2$) and resistivity of 2 to 10 kilo-ohms (more preferably, 3 to 8 kilo-ohms) as measured by mulitimeter probes set 1 cm apart.

Prior to application of the conductive material, the fabric is fully dried. The PTC layer 12 and conductive layer 14 are applied as discreet layers in any order of application. The conductive material 14 may be formulated from polymeric resins such as vinyls, polyesters, acrylics and conductive material such as silver pigment, a silver coated copper pigment, or plated copper pigments and/or solvating materials such as organic solvents, and water-based solvents which contain the conductive material. After thorough mixing, the coating is passed through a mill to effect final dispersion. Other conductive materials may be used such as conductive woven wires fixed within the construction by conductive glues. The applicants have found that these formulations are flexible while resisting cracking when bearing a load and when stretched.

The conductive material 14 is preferably applied in an interdigitating pattern (see Fig. 1) by a screen printing method, then fully dried, thereby forming an electrical buss system. Other methods may be used to apply the conductive material, including spraying, draw down applications, web printing, or other printing methods that provide a uniform coating. The

conductive material is printed in electrode patterns which are interdigitated. Each electrode of the pattern is in electrical contact with one of a multiple of buss bars 16 and 18, with adjacent electrodes alternating their connection between buss bars 16 and 18. The buss bars are configured in a decreasingly tapered arrangement. That is the width of the buss bars gradually decreases from the terminal end (20, 22) to the free end (24, 26). This insures that the electrical resistance created by the buss bars will create a heating effect that is substantially the same as that created by the heating areas. One knowing the electrical characteristics of the PTC material, conductive material and temperature requirements can readily design heating areas of varying sizes and shapes with varying buss sizes that can deliver varying amounts of heat over the heating area. Accordingly, the entire substrate, from the center out of the periphery, including those areas beneath the buss bars, will be heated as desired with substantially no cold spots. It should be noted that while the connections to the heater construction are positioned along its edges, other configurations are possible, such as making a connections from the interior of the construction, or a combination of connections along the edges and in the interior.

Power across the heater construction can be varied by varying the spacing of the smaller busses. That is, the skilled artisan would readily appreciate that doing so would vary the power at any given location in the construction.

Figure 2 shows a circuit diagram for a self-regulating flexible heater design in accordance with the present invention which provides for a multiple wattage heater. As shown in this design, high/low settings are possible where current flows from either common to high buss arrangement or a common to low buss arrangement. Other combinations are possible based on other terminal connections

Terminals 20 and 22 are attached to the buss bars and are in communication with a power source (not shown). The terminals may be attached to the buss bars 16 and 18 by fasteners or any other means that will permit an electrical contact to be formed. A secondary protective layer, such as an encapsulating layer, may be laminated over the heater assembly 30.

When a voltage is applied across the terminals and across the electrode array, depending upon the ambient temperature and the electrical characteristics of the PTC material, current will flow through the PTC material between the electrodes, generating heat in the individual heating areas. The current flow and heating effect of the PTC material depends on its temperature which will change as the ambient temperature changes and, at a predetermined temperature of the PTC material, the resistivity of the material increases causing the material to no longer conduct current, whereby the heating areas no longer generate heat, or to produce a very low amount of heat due to a significantly reduced current flow. Accordingly, it can be seen that the heater is self- regulating in accordance with the surrounding ambient temperature.

Figure 3 depicts an alternative arrangement in which the width of the buss bars is a combination of a section where the size remains constant near the free end (24, 26), and a tapered section where the buss bars gradually decrease in size further away from the terminal end (20, 22).

The skilled artisan will readily appreciate that placing a safety switch at the terminals will prevent run away conditions during which the heat generated exceeds the upper limit that has been set in the design of the heater. The switch can be a simple on-off switch that permits the user to turn off the current flowing through the heater.

Example 1

The thermal diffusivity of five coated polyester fabric sample was determined.

The samples, identified as 1 through 5, differed in terms of the whether they are woven or non-woven, and if woven, the weave pattern, number of picks per inch, ends per inch, number of filaments in the warp and filling yarns, and twists per inch in the yarns. These fabrics were submitted as strips of coated fabric approximately 500 mm long by 70 mm wide. Samples 12.7 mm in diameter were die cut from the strips for testing.

Thermal diffusivity of the samples was measured att 10° and 100° by the laser flash method utilizing a Holometrix Microflash instrument available from Holometrix Micromet. This instrument and method conform to ASTM E1461-92, "Standard Test Method for Thermal Diffusivity of Solids by the Flash Method". The test results are given after a description of the experimental procedure.

Thermal diffusivity is related to the steady-state thermal conductivity through the equation

$$D = \frac{\lambda}{C_p \rho}$$

where D is the thermal diffusivity, λ is the thermal conductivity, C_p is the specific heat, and ρ is the density. The diffusivity is a measure of how quickly a body can change its temperature; it increases with the ability of a body to conduct heat (λ) and it decreases with the amount of heat needed to change the temperature of a body (C_p). All three quantities on the right hand side of Equation (1), as well as the thermal diffusivity, can be functions of temperature.

The measurement of the thermal diffusivity of a material is usually carried out by rapidly

heating one side of a sample and measuring the temperature rise curve on the opposite side. The time that it takes for the heat to travel through the sample and cause the temperature to rise on the rear face can be used to measure the through -plane diffusivity and calculate the through-plane thermal conductivity if the specific heat and density are known.

Through-Plane Method and Analysis

The sample is a disk with a standard diameter of 12.7 mm and a thickness ranging from about 0.1 to 3 mm. With the Holometrix Thermaflash 2200 Laser Flash system, the sample disk is aligned between a neodymium glass laser (1.06 μm wavelength, 330 μs pulse width) and an indium antimonide (InSb) IR detector in a tantalum tube furnace. A type C thermocouple in contact with the sample controls the sample and its surroundings at any temperature between 20 and 2000°C. Once the sample has been stabilized at the desired temperature, the laser is fired several times over a span of a few minutes and the necessary data is recorded for each laser "shot". The laser beam energy strikes and is absorbed by the front surface of the sample, causing a heat pulse to travel through the thickness of the sample. The resulting sample temperature rise is fairly small, ranging from about 0.5 to 2 degrees C. This temperature rise is kept in the optimum range by adjustable filters between the laser and the furnace. A lens focuses the back surface image of the sample onto the detector and the temperature rise signal vs. time is amplified and recorded with a high speed A/D converter.

Conductivity

The sample thermal conductivity can be calculated with Equation (1), after a measurement of the diffusivity as described above, and with measurements of the sample specific heat and bulk density. The bulk density is normally calculated from the measured sample volume (calculated from the measured dimensions) and mass.

Test Results

The measured values of thickness, bulk density and thermal diffusivity are given in table 1 below. The results have not been corrected for thermal expansion. The samples were coated with approximately 5 μm of graphite for thermal diffusivity testing. The second column from the right in Table 1 lists the standard deviation as a percentage of the mean diffusivity for the five to ten laser "shots" taken for each data point. The bulk density values are estimated to be accurate to within ±5%.

Table 1

Laser Flash Thermal Diffusivity Results

	Thickness @ 25°C	Bulk Density @ 25°C	Temperature Tested	Thermal Diffusivity α	Fabric Type
Sample	(mm)	(g/cm^3)	(°C)	(cm^2/s)	
1	0.288	0.634	10 100	0.00360 0.00297	B-3 Polyester
2	0.180	0.555	10 100	0.00647 0.00562	B-2 Polyester
3	0.220	0.677	10 100	0.00617 0.00505	IFC 322-222 Polyester
4	0.269	0.510	10 100	0.00242 0.00205	non-Woven Polyester
5	0.556	0.910	10 100	0.00255 0.00203	PUR Coated Polyester

Note:Thermal Diffusivities are an average of 5 readings.

Example 2

The five polyester test samples discussed in example 1 were tested to determine if they would break down when subjected to extended period of operation. The samples were coated with PTC material. After drying a silver pigment was applied on top of the PTC material. These self-regulating flexible heater constructions were subjected to a 12 volt DC potential for an extended, continuous period. Heat continued to rise in the constructions, until steady state was attained for construction nos. 1 and 3. These constructions exhibited sufficient heat resistance. Constructions 2, 4 and 5 were destroyed before reaching steady state. That is, the "failed" heater constructions burned up during testing as a result of heat generated during heater operation. It is noted that the fabrics which passed exhibited a bulk density of at least about 0.6 g/cm^3 or greater and a thermal diffusivity of at least about 0.003 cm^2/s.

Laser Flash Thermal Diffusivity Results

	Thickness @ 25°C	Bulk Density @ 25°C	Temperature Tested	Thermal Diffusivity α	Fabric Type	Heater Construction
Sample	(mm)	(g/cm^3)	(°C)	(cm^2/s)		Pass/Fail
1	0.288	0.634	10 100	0.00360 0.00297	B-3 Polyester	Barely Passed
2	0.180	0.555	10 100	0.00647 0.00562	B-2 Polyester	Failed
3	0.220	0.677	10 100	0.00617 0.00505	IFC 322-222 Polyester	Passed
4	0.269	0.510	10 100	0.00242 0.00205	non-Woven Polyester	Failed
5	0.556	0.910	10 100	0.00255 0.00203	PUR Coated Polyester	Failed

Note: Thermal Diffusivities are an average of 5 readings.

With respect to the fabric selection process, it has been found that heater constructions having a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s or greater insures a desirable degree of conductivity and heat flow through the fabric. This can be achieved using multifilaments with a relatively high number of twists per inch. However, a high degree of twists, or even using high denier fibers, reduces fabric flexibility. Accordingly, the skilled artisan should strike a balance between these properties.

Though described in its preferred embodiment as a seat heater for automobiles, it should be understood that the self-regulating flexible heater construction of the present invention is suited for use not only in automobile components but has use in other applications, including but not limited to furniture pieces, consumer items, construction materials, and other articles. Accordingly, the preceding disclosure should be read as providing context to the invention, and not as a limitation on the field of use thereof.

Having described the preferred construction of the invention, those skilled in the art having the benefit of the description, can readily devise other modifications and such other modifications are to be considered to be within the scope of the appended claims.

WE CLAIM:

1. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

a flexible fabric substrate;

a layer of a positive temperature coefficient material; and

a layer of a conductive material.

2. The heater of claim 1 wherein the substrate is woven or non-woven fabric.

3. The heater of claim 1 wherein the layer of conductive material is applied to the layer of positive temperature coefficient material in an interdigitated pattern.

4. The heater of claim 1 wherein the layer of positive temperature coefficient material is applied to the layer of conductive material in an interdigitated pattern.

5. The heater of claim 1 wherein the density of the fabric is 1 to 6 ounces per square yard.

6. The heater of claim 1 wherein the PTC material is comprised of a polyolefin resin.

7. The heater of claim 1 wherein the coating of PTC material has a weight 7 to 20 lbs. per ream.

8. The heater of claim 1 wherein the positive temperature coefficient material has a surface

resistivity of 2 to 10 kilo-ohms as measured by multimeter probes set 1 cm apart.

9. The heater of claim 1 wherein the positive temperature coefficient material has a surface resistivity of 3 to 8 kilo-ohms as measured by multimeter probes set 1 cm apart.

10. The heater of claim 1 wherein the conductive material is formulated from a mixture of a polymeric resin selected from the group consisting of vinyls, polyesters, acrylics and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

11. The heater of claim 1 wherein the conductive material is formulated from a mixture of solvating materials selected from the group consisting of organic solvents and water based solvents and a conductive material selected from the group consisting of silver pigment, a silver coated copper pigment, or plated copper pigments.

12. The heater of claim 1 wherein the conductive material is constructed of conductive wires fixed within the construction by conductive glues.

13. The heater of claim 1 wherein the first and second layers are applied to the substrate by screen printing, spraying, draw down, web printing or any other printing method capable of providing a uniform coating.

14. The heater of claim 1 further comprised of a plurality of buss bars in electrical contact

with the conductive material and an electrical power source.

15. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width decreases over at least a portion of its length.

16. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width remains constant over at least a portion of its length.

17. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and at least one void at a preselected location along its length.

18. The heater of claim 14 wherein the buss bars have a width dimension and a length dimension, and wherein the width dimension increases step-wise over at least a portion of its length.

19. The heater of claim 14 wherein the spacing of the busses varies across the heater.

20. The heater of claim 1 further comprised of an overlayer of a laminated or sewn secondary breathable woven or non-woven fabric comprised of natural or synthetic fibers which covers the heater.

21. The heater of claim 20 wherein the overlayer is an encapsulating coating, which may be a flame retardant coating, which is applied over the heater elements.

22. The heater of claim 1 wherein the heater is incorporated within the construction of a seat for an automobile.

23. The heater of claim 1 wherein the heater has a multiple buss design providing for high and low current settings, comprised of at least a common setting buss, a low setting buss, and a high setting buss, in which current flows from either the common setting buss to high setting buss or from the common setting buss to low setting buss.

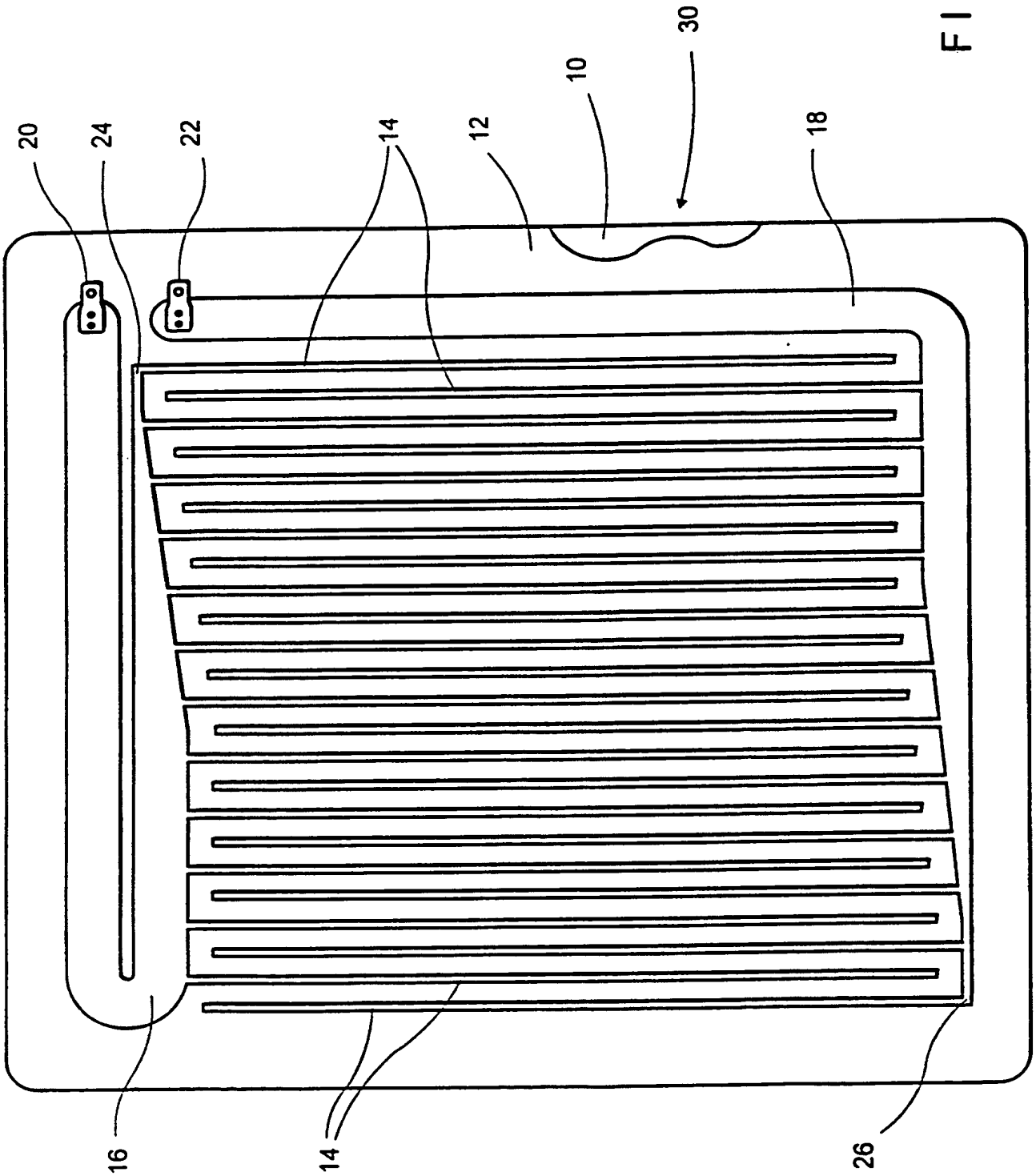
24. A self regulating flexible heater construction for producing heat when connected to an electrical power source, comprised of:

a flexible fabric substrate;

a layer of a positive temperature coefficient material; and

a layer of a conductive material, wherein the seat heater composition has a bulk density of about 0.6 g/cm^3 or greater and a thermal diffusivity of about 0.003 cm^2/s or greater.

FIG. 1



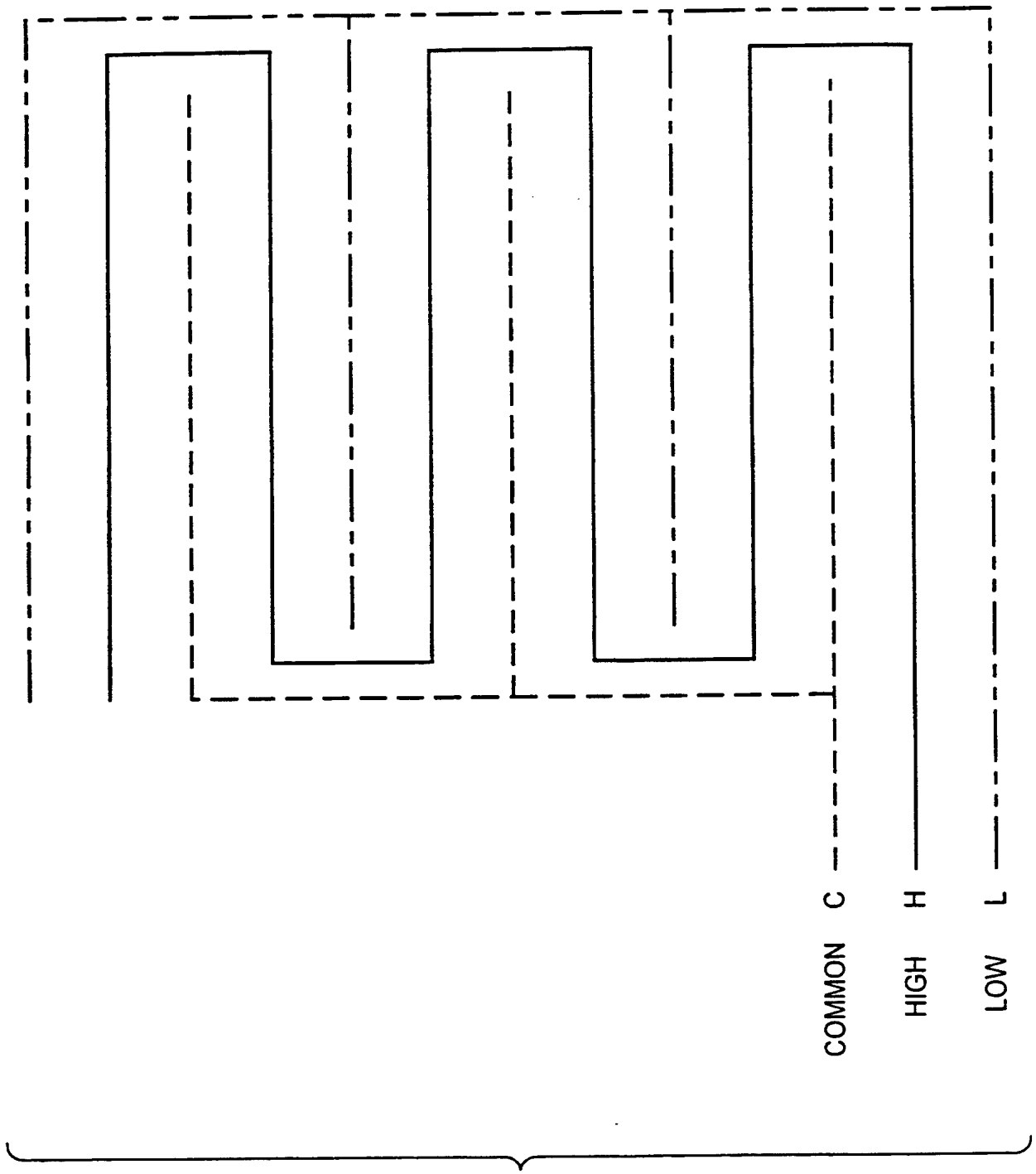


FIG. 2

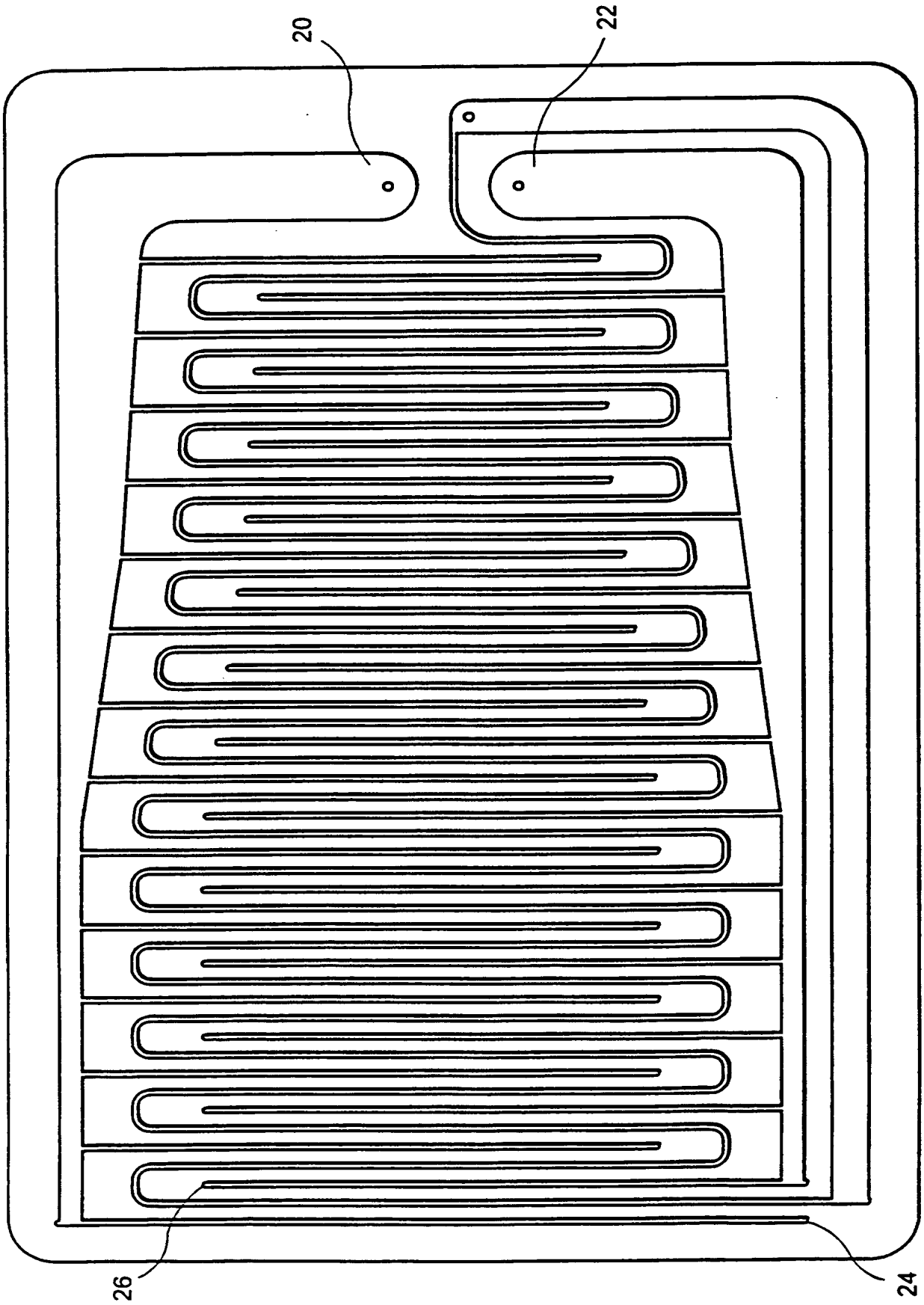


FIG. 3

MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: GERALD LEVY
PITNEY, HARDIN, KIPP AND SZUCH LLP
711 THIRD AVENUE
NEW YORK NY 100

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 3029-72	Date of Mailing *(day/month/year)* 06 JUL 2000
International application No. PCT/US00/01702	FOR FURTHER ACTION See paragraphs 1 and 4 below
Applicant SURJAN, JAMES	International filing date *(day/month/year)* 24 JANUARY 2000

1. [X] The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the ~~international search report~~; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. [ ] **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

[ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

[ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 *bis* 1 and 90 *bis* 3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer TU HOANG Diane Smith for Telephone No. (703) 308-3303

Form PCT/ISA/220 (July 1998)★ *(See notes on accompanying sheet)*

Attorney Docket No: 3029-72 US
Express Mail Label: ET025234409US

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 3029-72	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US00/01702	International filing date *(day/month/year)* 24 JANUARY 2000	(Earliest) Priority Date *(day/month/year)* 25 JANUARY 1999
Applicant SURJAN, JAMES		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readable form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (See Box II).

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   [ ] the text is approved as submitted by the applicant.

   [X] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

NEW ABSTRACT

A self-regulating flexible heater for automobiles and other vehicles which is comprised of a breathable substrate (10) to which is applied a coating (14) of a conductive material and a coating (12) of positive temperature coefficient material.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/01702

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :H05B 3/34
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,845,343 A (AUNE et al) 04 July 1989, see abstract, column 7, lines 37-55, and Figures 1-2.	1-2, 5-12, 14, 16, and 20-22.
X	US 4,857,711 A (WATTS) 15 Agust 1989, see column 1, lines 44-56, column 2, line 42 to column 3, line 34, and Figures 1-2.	1-21 and 23.
X	US 5,824,996 A (KOCHMAN et al) 20 October 1998, see Figures 10 A-10C, column 6, lines 1-26 and column 11, and lines 26-39.	1-4, 6, 10-14, 16, and 20-23.
X	US 5,451,747 A (SULLIVAN et al) 19 September 1995, see the entire reference.	1-14, 16, and 20-21 .
A, P	US 5,961,869 A (IRGENS) 05 October 1999, see the entire reference.	1-24.

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 22 MAY 2000	Date of mailing of the international search report 06 JUL 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer TU HOANG Diane Smith for Telephone No. (703) 308-3303

Form PCT/ISA/210 (second sheet) (July 1998)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/01702

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,197,595 A (COULTAS) 30 March 1993, see the entire reference.	1-24.
A	US 5,111,025 A (BARMA et al) 05 May 1992, see the entire reference.	1-24.
A	US 4,761,541 A (BATLIWALLA et al) 02 August 1988, see the entire reference.	1-24.
A	US 5,851,588 A (UTHOFF, JR.) 22 December 1998, see entire reference.	1-24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/01702

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

219/549

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

219/202, 212, 217, 219, 520, 528, 529, 538, 546, 547, 548, 549, 553